PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	**FOR FURTHER ACTION** See Form PCT/IPEA/416	
303813WO/PRS/GJS		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IB2004/004250	16-12-2004	19-12-2003
International Patent Classification (IPC) or national classification and IPC		
See Supplemental Box		
Applicant		
Nokia Corporation et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 5 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
19-10-2005	16-03-2006
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Göran Magnusson/MN Telephone No. +46 8 782 25 00

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of: Cover sheet

INTERNATIONAL PATENT CLASSIFICATION (IPC):

G01S 1/00 (2006.01)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB2004/004250

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of:

- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-24 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished
pages* _____ as amended (together with any statement) under Article 19
pages* 25-29 received by this Authority on 2005-10-19
pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-7 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing *(specify)*: _____
- ☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing *(specify)*: _____
- ☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-23	YES
	Claims		NO
Inventive step (IS)	Claims	1-23	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-23	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The invention concerns a GPS device and solves the problem of maintaining synchronisation to GPS system time.

Documents cited in the International Search Report:
D1: EP 1130415 A
D2: US 6122506 A
D3: EP 1092987 A

Document D1 describes a GPS device comprising a first circuit (GPS receiver 9,10) arranged to receive a first signal and output first timing information and a second circuit (radio wave clock block 4-6) arranged to receive a second signal and output second timing information. A third circuit 3 produces third timing information dependent on the first and second signals. The third timing information is initially synchronised to the first timing information (see paragraph [0038], lines 30-39) and maintained substantially synchronised to the first signal using the second timing information (see paragraphs [0047] and [0049]).

Document D2 discloses the combination of a GPS receiver with a cellular telephone wherein a GSM reference generator 102 and a cellular communications signal including a frequency correction signal is used for obtaining a frequency reference for the GPS receiver (see column 3, lines 48-62; column 7, lines 39-57 and figure 8).

Document D3 discloses a system similar to D1.

However, none of the documents disclose the producing of a

.../...

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of: Box V

location estimate dependent on the first and third timing information, the third timing information being maintained synchronised to the first signal using a cellular reference clock.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed device and method. Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-23 is novel and is considered to involve an inventive step. The invention is industrially applicable.

PCT / IB 2004 / 0 0 4 2 5 0

1 9 -10- 2005

Claims

1. A GPS device comprising:

a first circuit arranged to receive at least one first signal and arranged to output first timing information dependent on said first signal;

a second circuit arranged to receive at least one second signal and arranged to output second timing information dependent on said second signal; and

a third circuit arranged to determine timing information of said device, said third circuit arranged to receive at least one of said first and second timing information, and further arranged to produce a third timing information dependent on at least one of received first and second signals,

wherein said third circuit is further arranged to produce a location estimate dependent on said first and third timing information;

wherein said third timing information is initially synchronised to said first timing information and maintained substantially synchronised to said at least one first signal using said second timing information; and

wherein said third circuit further comprises a cellular reference clock and wherein said third timing information is further maintained substantially synchronised to said at least one first signal using said cellular reference clock.

2. A device claimed in claim 1 wherein said first signal comprises a Global Positioning Satellite system signal.

3. A device as claimed in claims 1 or 2, wherein said second signal comprises a cellular network control or communications signal.

PCT / IB 2004 / 0 0 4 2 5 0
19 -10- 2005

4. A device as claimed in claims 1 to 3, wherein said first timing information comprises at least one of:

a demodulated Global Positioning Satellite system time;

at least one Global Positioning Satellite system pseudo-range;

a demodulated Global Positioning Satellite system timing data word.

5. A device as claimed in claims 1 to 4, wherein said second timing information comprises at least one of:

cellular network base station symbol timing;

cellular network base station frame timing.

6. A device as claimed in claims 1 to 5, wherein said first circuit comprises a Global Positioning Satellite receiver.

7. A device as claimed in claims 1 to 6, wherein said second circuit comprises a cellular network receiver.

8. A device as claimed in any previous claim, wherein said third circuit comprises:

a GPS demodulator;

a timing estimator;

a location estimator; and

a clock register.

9. A device as claimed in claim 6, wherein said first circuit further comprises:

a GPS demodulator; and

a timing estimator.

PCT / IB 2004 / 0 0 4 2 5 0
19 -10- 2005

10. A device as claimed in claim 9, wherein said third circuit comprises:

a location estimator and a clock register.

11. A device as claimed in any previous claim, wherein said second and third circuit is implemented in a single circuit.

12. A device as claimed in any previous claim, wherein said device further comprises a threshold circuit arranged to further substantially synchronise said third timing information to said at least one first signal dependent on a threshold event.

13. A device as claimed in claim 12, wherein said threshold circuit is arranged to further substantially synchronise said third timing information using said first timing information.

14. A device as claimed in claims 12 or 13, wherein said threshold event comprises at least one of:

a time period;

a movement of said device out of a building;

a movement of said device following a period of relative static nature;

a determined number of base station handovers;

a received first signal strength threshold;

a number of received first signals.

15. An integrated circuit comprising a GPS device as claimed in any previous claim.

16. A device as claimed in claim 8 wherein said clock register comprises random access memory.

PCT / IB 2004 / 0 0 4 2 5 0
19 -10- 2005

17. A method for determining the position of a device using GPS, the device comprising a cellular reference clock, the method comprising the steps of:

receiving at least one first signal;

producing first timing information dependent on said at least one first signal;

receiving at least one second signal;

producing second timing information dependent on said at least one second signal;

producing third timing information dependent on said at least one of said first and second timing information;

initially synchronising said third timing information to said first signal, maintaining synchronisation to said first signal using said second timing information, and further maintaining synchronisation to said first signal using said cellular reference clock, and

determining a location of said device dependent on said first timing information and said third timing information, wherein said determining step comprises the step of calculating a difference between said third timing information and said first timing information to determine location estimates.

18. A method as claimed in claim 17, wherein said step of receiving at least one first signal comprises;

receiving at least four GPS signals.

19. A method as claimed in claim 18, wherein said step of producing at least one first timing information further comprises;

processing said at least four received GPS signals to determine at least four GPS timing signals;

PCT / IB 2004 / 0 0 4 2 5 0
19 -10- 2005

processing said at least four GPS timing signals to produce a true GPS timing signal.

20. A method as claimed in claim 17, wherein said step of receiving at least one second signal comprises;

receiving at least one communications or control signal from a wireless cellular communications system base station.

21. A method as claimed in claims 18 to 20, wherein said step of producing said third timing information comprises a further step of triggering a threshold circuit arranged to further substantially synchronise said third timing information to said at least one first signal dependent on a threshold event.

22. A method as claimed in claim 21, wherein said further step of triggering said threshold circuit is arranged to further substantially synchronise said third timing information using said first timing information.

23. A method as claimed in claims 21 and 22, wherein said step of triggering said threshold circuit further comprised the detection of a threshold event comprising at least one of:

a time period;

a movement of said device out of a building;

a movement of said device following a period of relative static nature;

a determined number of base station handovers;

a received first signal strength threshold;

a number of received first signals.